

INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET

International application No. PCT/IT 03/00510

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following document:

D1: WO 01/24580 A (SUNBEAM PRODUCTS INC) 5 April 2001 (2001-04-05)

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and shows (the references in parentheses applying to this document):

A heat blanket comprising an operative unit and a control/power supply unit which can be electrically connected on one side to the power mains and on the other side to the operative unit, wherein:

a) the operative unit comprises:

- a foldable sheet,
- a linear heating element distributed in the sheet

b) the control/power supply unit comprises:

- a power supply group for the heating element
- control means of the power supply for the heating element, wherein the control means comprise:
 - a power supply cut-off means for the heating element,
 - a microprocessor(220), connected to the heating element, to the power supply group and to the cut-off group, set to detect possible anomalies in the power supply conditions of the heating element and to act upon the cut-off group interrupting the power supply of the heating element when said anomalies take place(page 7, lines 6 to 14; figure 1B).

The subject-matter of claim 1 differs from this known heat blanket in that the microprocessor classifies each detected anomaly either as a temporary anomaly or as a definitive anomaly, and in that the interruption of the power supply is reversible in case of a temporary anomaly and irreversible in case of a definitive anomaly.

**INTERNATIONAL PRELIMINARY
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The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as how to design a heating blanket that is safe to use and at the same time allows to continue using it in case of minor safety incidents.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) since the way the microprocessor deals with anomalies in it is neither known, nor rendered obvious by D1 (or any other document part of the prior art). Other documents deal with safety issues but none of them makes this distinction between temporary and definitive anomalies. Additionally, the above-stated technical problem is also not addressed by D1 and none of the control schemes disclosed by D1 would solve this problem.

Claims 2 to 20 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

10. MAR. 2005 17:22 PCA +39 02 58301263
IME012BWO

NR. 467 P. 3/16

-3-

WO 01/24580 A discloses a remote control system for an electric heat blanket. This system includes a power supply having control means with a circuitry capable of monitoring safety conditions in the blanket and of deactivating the power supply when needed.

5 US 2001/008236 A1 discloses a safety circuit for an electric heat blanket. This circuit can detect both shorts and breaks and consequently disconnect power when needed.

10 US-A-5105067 discloses a control system for a heated garment. The system includes a protection circuit that is able to modulate the power supply according to the detected voltage drop.

15 US 2003/047556 A1 discloses a warming blanket having a safety circuit. The circuit includes means for detecting fault conditions in the blanket by checking the value of the current; when a fault condition is detected, the power is switched off.

The present invention addresses the problem of further improving the safety conditions of a heat blanket.

20 Consequently, this invention concerns a heat blanket according to claim 1.

The use of a microprocessor allows the variation of the power supply conditions in the heating element to be recognised with the maximum accuracy, and thus ensures 25 rapidity and versatility of intervention in case of anomalies, substantially improving the safety of the

-5-

the blanket;

- number and type of anomalies detected.

According to a characteristic of the invention, each anomaly detected is classified by the microprocessor, either as a temporary anomaly or as a definitive anomaly, whereas the interruption of the power supply of the heating element is reversible in case of temporary anomaly and irreversible in case of definitive anomaly. In this way, an anomaly in any case determines the interruption of the power supply, preventing situations of danger; however, the following behaviour is differentiated according to the type of anomaly detected. Indeed, some anomalies may be due to temporary problems which can be corrected by itself or with a small intervention by the user; this is the case, for example, of overheating (after it has been cooled down the conditions can once again be perfectly safe), or else of interruption of electric conduction in the heating element (this could simply be due to an imperfect electric coupling between the operative and control/power supply units). On the other hand, a situation of short circuit is certainly a source of ranger, whatever its cause, and it is thus advisable to exclude the possibility of even just an attempt to switch it back on. A request for a periodical maintenance check may be classified either as a temporary anomaly, or as a definitive anomaly. The first case is preferable if one wishes to leave the user with a certain freedom, whereas the second case is preferable if one wishes to prioritise safety. A block due to a definitive anomaly can be nullified only by an intervention of the authorised assistance service.

Preferably, a temporary anomaly is reclassified by the microprocessor as a definitive anomaly if it reoccurs a predetermined number of times consecutively. The reoccurrence of the same anomaly, indeed, is normally an indication of a permanent structural problem, which thus

10. MAR. 2005 17:22

PCA +39 02 58301263

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NR: 467 P. 5/16

AP2005 02 07 2006 10 FEB 2006

- 18 -

CLAIMS

1. Heat blanket comprising an operative unit (20) and a control/power supply unit (40) which can be electrically connected on one side to the power mains and on the other side to the operative unit (20), wherein:

5 a) the operative unit (20) comprises:

- a foldable sheet (21),
- a linear heating element (22) distributed in the sheet (21), with a first (24) and a second (26) conductor extending one along the other, separated by a first electrically insulating material (25) and enclosed by a second electrically insulating material (27), wherein the first (24) and the second (26) conductors are electrically connected to the control/power supply unit (40) and have respective first terminals (24a) inside the sheet (21), connected together; and

10 b) the control/power supply unit comprises:

- a power supply group (41) for the heating element (22), intended for connection to the electric mains,
- control means (45, 50) of the power supply for the heating element (22), such control means including:
- a power supply cut-off group (45) for the heating element (22),
- a microprocessor (50), connected to the heating element (22), to the power supply group (41) and to the cut-off group (45), set to detect possible anomalies in the power supply conditions of the heating element (22) and to act upon the cut-off group (45) interrupting the power supply of the heating element (22) when said anomalies take place; characterised in that each anomaly detected is classified by the microprocessor (50) either as a

10. MAR. 2005 17:22

PCA +39 02 58301263

NR. 457

P. 6/16

IME012BWO

-19-

5 temporary anomaly or as a definitive anomaly, and wherein the interruption of the power supply of the heating element (22) is reversible in case of a temporary anomaly and irreversible in case of a definitive anomaly.

10 2. Heat blanket according to claim 1, wherein said anomalies include one or more of the following conditions:

- interruption of electric conduction in the heating element (22);
- short circuit in the heating element (22);
- overheating of the heating element (22);
- need or suitability of periodic maintenance.

15 3. Heat blanket according to claim 1, wherein a short-circuit in the heating element (22) and/or a need or suitability of periodical maintenance are classified as a definitive anomaly.

20 4. Heat blanket according to claim 3, wherein a decrease in impedance greater than a predetermined value, preferably 5%, is considered a short circuit.

25 5. Heat blanket according to claim 1, wherein overheating in the heating element (22) and/or an interruption in electric conduction in the heating element (22) and/or a need for or suitability of periodical maintenance are classified as temporary anomalies.

30 6. Heat blanket according to claim 1, wherein a temporary anomaly is reclassified as a definitive anomaly if it repeats a predetermined number of times.

7. Heat blanket according to claim 1, wherein the first and second conductors (24, 26) are coaxial, the first conductor (24) being wound in a spiral around a core

10. MAR. 2005 17:23

PCA 439 02 58301263

IME012BWO

NR. 467

P. 7/16

- 20 -

5 (23), the second conductor (26) being wound in a spiral around the first conductor (24) with interposition of the first electrically insulating material (25), and wherein the first electrically insulating material (25) has a melting point of between 100 and 160 °C, preferably equal to about 120 °C.

10 8. Heat blanket according to claim 1, wherein the cut-off group (45) comprises, in series on the power supply of the conductors (24, 26), a first electronic operating switch (46), which activates or deactivates the electric conduction upon the command of the microprocessor (50) based upon the temperature of the heating element (22).

15 9. Heat blanket according to claim 8, wherein the electric resistance of the heating element (22) increases as the temperature increases and wherein the microprocessor (50) detects the temperature of the heating element (22) by a measurement of such an electric resistance.

20 10. Heat blanket according to claim 8, comprising an adjustable temperature setting group (51) of the heating element (22) connected to the microprocessor (50), and wherein the first electronic operating switch (46) activates or deactivates the electric conduction upon the command of the microprocessor (50) also based upon the setting of the adjustable temperature setting group (51) of the heating element (22).

25 11. Heat blanket according to claim 8, wherein the cut-off group comprises, in series on the power supply of the conductors (24, 26) and in series with the first electronic operating switch (46), a second electronic emergency switch (47).

10. MAR. 2005 17:23

PCA +39 02 58301263

NR. 467

P. 8/16

IME012BWO

-21-

12. Heat blanket according to claim 11, wherein the second electronic emergency switch (47) is such as to interrupt the circuit unless it is receiving a predetermined signal which is dependent upon an output signal from the microprocessor (50).
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13. Heat blanket according to claim 11, wherein the second electronic emergency switch (47) is such as to interrupt the circuit in the case in which the resistance of the heating element (22) exceeds a predetermined threshold, independently of any command of the microprocessor (50).
10
14. Heat blanket according to claim 13, wherein the predetermined threshold is adjustable through the adjustable temperature setting group (51).
15. 15. Heat blanket according to claim 1, comprising a signal indicator light (52), commanded by the microprocessor (50) according to specific and different cycles according to the classification of the anomaly detected.
15
20. 16. Heat blanket according to claim 15, comprising a timer for the automatic interruption of the power supply of the heat blanket after a predetermined time, such an automatic interruption being indicated by a specific indication cycle of the signal indicator light (52).
25
17. Heat blanket according to claim 1, comprising an on-off indicator light (44), to indicate the electric power supply of the heat blanket.
18. Heat blanket according to claim 15, comprising an on-off indicator light (44), to indicate the electric power supply of the heat blanket, wherein the signal indicator light (52) and the on-off indicator light (44) are distinct and different from each other.
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10. MAR. 2005 17:23

PCA +39 02 58301263

IME012BWO

NR. 467

P. 9/16

-22-

19. Heat blanket according to claim 1, wherein the microprocessor (50) automatically and periodically activates a self-diagnosis procedure, simulating its own failure, checking the correct intervention of the cut-off group (45) and finally either restoring its operation in case of correct operation of the cut-off group (45) or else indicating an anomaly in case of irregular operation of the cut-off group (45).
5
20. Heat blanket according to claim 2, wherein the need or suitability of programmed maintenance is established by the microprocessor (50) based upon one or more of the following parameters:
10
 - total time that the blanket has been switched on;
 - total lifetime of the blanket;
 - total number of switching on and off cycles undergone by the blanket;
 - number and type of anomalies detected.
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